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THE PARATHYROID GLANDULES. THEIR BLOOD SUPPLY, AND THEIR PRESERVATION IN OPERATION UPON THE THYROID GLAND.

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THE BLOOD SUPPLY OF THE HUMAN PARATHYROID GLANDULES. HERBERT M. EVANS. The vascular injections and studies herein reported were made to determine accurately the exact source and position of the blood supply to the parathyroid glands in man. Another aim, that of knowing more of the angiology of the parathyroid gland itself, was also served, but this subject will be reported separately at a later date. I would here express my indebtedness to Professor Halsted at whose suggestion the problem was undertaken, to Professor Mall in whose laboratory the injections were made, to Professor W. G. MacCallum, Dr. H. E. Helmholz and especially Dr. Marshall Fabyan who have kindly given me many opportunities to secure fresh human material, and to Mr. Broedel whose advice I found invaluable in the execution of the drawings.

Methods.—Recent studies in the finer anatomy and histology of mammals have shown many distinct differences so that it would be no longer justifiable to assume that the findings in the dog, for example, must be identical with those in man. Such a contention is especially strengthened in this particular case by the variation in the size and position of the parathyroid bodies in the animals which have thus far been investigated. With a full realization of this, all of the present work was done on human material. Very different circulatory relations than are here reported may be found in all those animals in which the parathyroid glands are imbedded in the thyroid. In the majority of cases the specimen was secured a few hours after death, the entire neck organs being removed en masse. The upper and lower poles of each lateral lobe of the thyroid were then carefully dissected sufficiently to identify the superior and inferior vessels in each case. In most instances, the superior arteries were ligated and the injection mass delivered through the inferior vessels, but in several cases the upper arteries were injected in addition. Though anastomoses generally permitted a partial injection of the opposite side, the two sides were always separately injected. Mercuric sulphide (vermilion) granules in a twenty per cent. gelatin solution were most often used as an injection mass and gave a splendid arterial injection which when long-continued could be made to invade the capillary bed. In several cases, the veins were filled with ultramarine blue and in still others the arteries were injected with india ink, which enters the capillaries with great facility. The entire specimen was immediately cooled in running water and a preliminary dissection made to locate the parathyroid glands. This seemed wise inasmuch as the detection of these glandules was easier in fresh material, in which the natural brownish color was retained, than in specimens in which they were blanched by the preserving fluid. A simple sketch of the position of the parathyroids was then made to be used in identifying them in the final dissection. The specimen was placed in a ten per cent. formalin solution for twenty-four hours, after which the tissues were sufficiently preserved to permit a careful dissection to be

made. Such dissections were accurately charted. Generally the parathyroid glands were ultimately removed, dehydrated in alcohols, and cleared in creosote for further study.

Observations.—Few studies of this region based on actual vascular injections have been made. However, D. A. Welsh,[1] whose excellent paper appeared in 1898, used the injection method. It is unfortunate that no figures of the vascular relations accompanied his study.

One of the first facts which appears after a satisfactory injection is that a special tiny parathyroid artery supplies this gland in every case. This artery may arise from one of the glandular, the muscular, or the œsophageal branches of the inferior thyroid artery, but wherever its origin, it can be seen definitely to supply the parathyroid gland and it alone. One may sometimes see one or two smaller arteries accompanying the parathyroid vessel, but they supply the small fat mass which often surrounds the parathyroid or lies on either side of it; my injections have never demonstrated more than one parathyroid vessel proper, and this enters a distinct hilus in the gland. Though practically all previous studies have not shown any real embedding of the human parathyroid in the tissue of the thyroid, the connective tissue envelope which surrounds the latter gland often appears to split to enclose the parathyroid. It was interesting, then, to observe what vascular connections existed between the capsule of the larger and the smaller glands. Complete injections have uniformly shown only the scantiest blood supply to this connective tissue envestment. It usually consists of a few minute vessels, for the most part capillaries. These are seldom seen to be in any relation with the parathyroid glands and never to be connected with the vascular system of the latter, which is always from the parathyroid arteries. This fact was more striking when observed in a rather unique case in which I found the parathyroids so deeply set in the surface of the thyroid that their surface was barely level with that of the larger gland. Here also there was

[1] Welsh, D. A., Jour. of Anat. and Physiol., 1898.

a definite independence of the vascular system of the parathyroid from that of its immediate surroundings. It is thus quite unlikely, even if not inconceivable that the true capsular vessels of the thyroid could nourish the parathyroids and in those cases in which the lower parathyroids lie below the lower pole of the thyroid, it is all the more improbable.

In practically every case studied, the lower parathyroid artery came from a prominent branch of the inferior thyroid artery. Ten entire specimens were found suitable for accurate plotting. This would ordinarily give twenty opportunities for examining the inferior parathyroid artery, but since the gland was not found in one instance, the actual number of observations was nineteen. In six instances the inferior parathyroid gland was clearly below the lower margin of the thyroid, and the parathyroid artery in these cases coursed as a distinct, usually unbranched, vessel to the hilus of the glandule. The findings of others would indicate that so great a proportion of these cases is probably a unique experience. In such cases, the parathyroid artery has measured between two and three centimeters in length; in all other cases its course is seldom in excess of four or five millimeters.

The upper parathyroid gland invariably has a short artery of supply which may arise from one of the main branches of the inferior thyroid or from an anastomosing ramus joining the superior and inferior thyroid arteries. A very prominent anastomosing channel was found along the posterior margin of the lateral thyroid lobe in eight of twenty instances and in these cases the superior parathyroid artery was a short branch from this channel. Most often, however, the angle at which the parathyroid vessel came off from its parent trunk suggested strongly that its blood stream was usually from the inferior source.

The conditions found thus varied somewhat, but with the constant features just emphasized. The special picture presented will depend to a considerable extent on the position of the parathyroids; and using this as a sort of basis of classification three common types may be specified. Figures 1 and 2

illustrate two varieties of what may be called the first type. Here the upper parathyroid lies along the posterior border of the lateral lobe of the thyroid somewhat above the mid-point between the upper and lower "poles"; the lower glandule lies near the lower thyroid margin or pole. It is not unlikely that this particular arrangement will be found occurring most often in a large series of cases. In Fig. 1, the lower para-

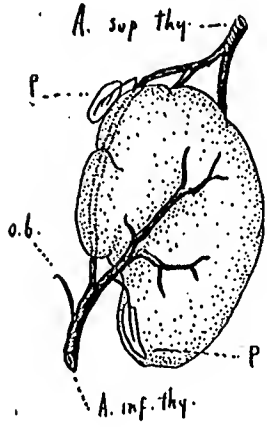


Fig. 1.

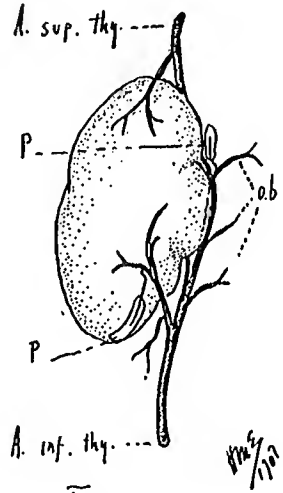


Fig. 2.

thyroid artery is seen to arise from the prominent lateral branch of the inferior thyroid artery which supplies most of the outer surface of the lateral thyroid lobe. The upper parathyroid artery here arises from the strong anastomosing channel between the upper and lower thyroid vessels which courses along the posterior border of the lateral lobe. In Fig. 2, the lower little artery comes from one of the lateral glandular rami of

the inferior thyroid, while the upper one happens to be a branch of the uppermost œsophageal ramus.

Figs. 3 and 4 will illustrate a type but little removed from that just discussed, but one in which the parathyroids are rather symmetrically disposed, the one above, the other below the mid-point between the thyroid poles. The condition shown

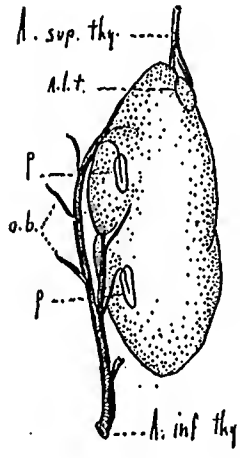


Fig. 3.

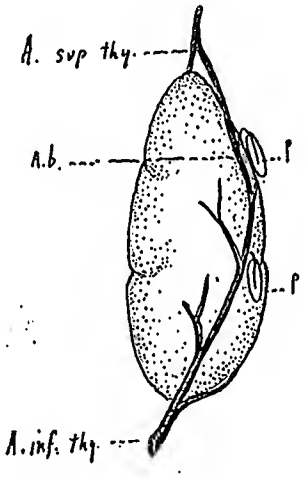


Fig. 4.

in Fig. 4 is interesting since here both parathyroid vessels came from the same large branch of the inferior thyroid, which in this case communicated with the superior thyroid artery.

In the third type, shown in the remaining two figures (5 and 6), is depicted the arrangement seen in those cases in which the lower gland is appreciably below the lower margin

of the thyroid. Here it is not unusual to find a relatively long parathyroid artery.

Various other modifications in the exact plan of blood supply were found, but, in general, the figures given illustrate the chief conditions.

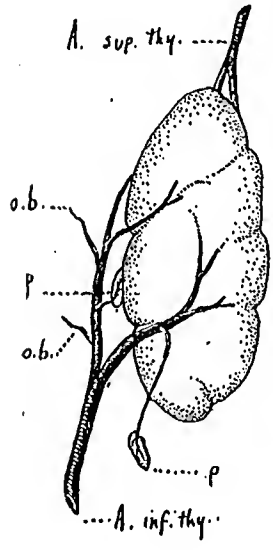


Fig. 5.

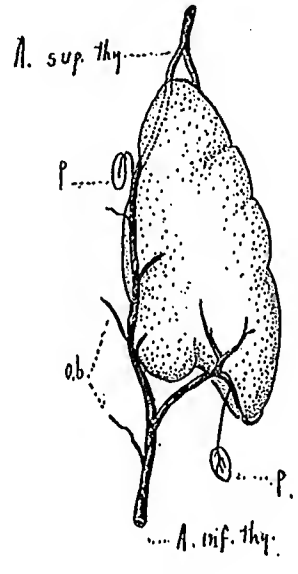


Fig. 6.

It is without the purpose of this communication to follow the behavior of the parathyroid artery after it enters the glandular hilus, but it may be said here that, in general, this vessel pursues a central course, giving off obliquely directed branches which ramify peripherally, eventually giving origin to capillaries. This picture may be seen beautifully in cleared specimens of the glandule and, it may be pointed out, is in

contrast to the scheme of circulation which obtains in the case of the thyroid gland.

The chief facts brought forward in the present report may be summarized as follows:

1. The parathyroid glands are always supplied by definite parathyroid arteries which enter them in each case at the hilus.

2. The parathyroid arteries, superior and inferior, usually arise from the inferior thyroid, but frequently they take origin from the anastomosing channel, described above, between the inferior and superior thyroid vessels. Additional types of origin of the parathyroid artery have been described and figured.

3. Few, if indeed any, direct vascular connections normally exist between the parathyroid glands and the connective tissue envelope of the thyroid.

THE PRESERVATON OF THE PARATHYROID GLANDULES IN OPERATION UPON THE THYROID LOBES. WILLIAM S. HALSTED. With our present knowledge, scant as it is, of the function of the parathyroid bodies comes not only the recognition of the necessity for their preservation but more frequent occasion for operations which imperil the vitality of these little life sustaining organs.

When tetany was believed to be due to thyroid privation the surgeon feared to operate upon both lateral lobes of the thyroid gland, having learned that the death rate from total excision of this organ was very great, and, that tetany, the chief cause of this mortality, might follow the excision of merely one lobe of the thyroid gland or ligation of two or even of one of the four thyroid arteries.

As long ago as 1889 it was discovered that dogs would survive the gradual excision of as much as thirty-one thirty seconds and of even a greater proportion of the thyroid gland provided the fraction remaining was the superior pole of either lobe. That tetany did not result was due to the fact, not surmised until the appearance of Gley's superb contributions in 1891, that the superior parathyroid body, situated in the dog very near to and usually a little above the superior pole of the

thyroid lobe had escaped destruction by this method of piecemeal excision, from below upwards, of the thyroid gland. In man, however, with gradual, piecemeal amputation from below upwards of the thyroid lobes destruction of all of the four parathyroid glandules would, as a rule, already be accomplished with the removal of the lower two thirds, approximately, of each lateral lobe: vid. figs. 2, 3 and 5. But even before it was ascertained that the parathyroid bodies had any function whatever a long series of happy accidents demonstrated that total excision of the thyroid gland might, in man, be survived in about fifty per cent. of the cases; in many instances, moreover, there was entire absence of symptoms of thyroid as well as of parathyroid insufficiency.

Only now that the function of the thyroid gland and the parathyroid glandules may no longer be so confounded, are we in a position to determine the amount of each of these organs likely to be necessary in a given case to prevent the occurrence of symptoms of deficiency of either. And even before this has been more definitely determined surgeons are justified in proceeding with greater intrepidity in operation involving the sacrifice of the thyroid and threatening the destruction of the parathyroid glands, believing that the symptoms of privation of each may be mitigated or entirely negatived by the administration in some form of the nucleoproteids or whatever substances are lacking.[2]

In the mean time our plan of operating not only for the exophthalmic or hypertrophic forms but also for the colloid, degenerative or atrophic varieties of goitre may be modified in conformity to our recently acquired knowledge of the function of the glandulæ parathyreoideæ. In place of the unilateral operation, heretofore almost exclusively practiced in cases of colloid or other nonhypertrophic varieties of goitre, a bilateral

[2] The patient suffering from hypoparathyreosis whose history is reported in the July number of the American Journal of Medical Sciences is rapidly being restored to health by the administration, hypodermically, of the nucleoproteids of the parathyroid glands of beeves, supplied me, most kindly, by Prof. S. P. Beebe, of Cornell, N. Y.

operation might be substituted in some cases; and in the hypertrophic goitres, the one lobe should be so operated upon, that, in case of need, the other may be subsequently attacked without danger of parathyroid privation. Even in the absence of the existing vital reasons which contraindicate the sacrifice of a single parathyroid glandule, the fact that these little organs perform some highly important function is sufficient reason for the endeavor to preserve all of them.

Although for more than a decennium we have known that operative tetany is due to loss of parathyroid tissue more cases of this affection have followed operation during this time than in the preceding quarter century; and, furthermore, at the hands of the operators most experienced in the surgery of the thyroid gland.

Dr. MacCallum, who has carefully studied the operative material from about eighty cases of exophthalmic goitre operated upon by the writer, reports having found in perhaps seven instances one parathyroid with the excised lobe. During the past two years this glandule has only twice, I believe, been excised by me with the thyroid lobe. Nevertheless it is quite certain that in most instances of complete excision of one thyroid lobe as reported by surgeons the world over both parathyroid glandules of the operated side have been sacrificed whether the trunks of the thyroid arteries were tied at some distance from the gland or the ultimate branches of distribution at their points of entrance into the thyroid lobe; and even when that portion of the thyroid in which the parathyroid glandules are quite uniformly found has been resected and left undisturbed, the latter bodies were undoubtedly often destroyed.

It is in the control of hemorrhage that we sacrifice the parathyroid glandules. But the hemorrhage must be controlled and thyroid vessels must somewhere be divided in the operation for the removal of a lobe of the thyroid gland. May they be so divided and secured as not to cut off the blood supply of the parathyroid glandules? Reply to this question is impossible without definite knowledge of the blood supply of these little bodies.

Dr. Mall did me an invaluable service in recommending Mr. Herbert M. Evans, of the class of 1908 of the Medical School of Johns Hopkins University as one particularly well equipped for making the investigations. Mr. Evans[8] undertook the work with enthusiasm, being interested both in the anatomical and the surgical aspect of the problem. Upon his report, which precedes, this paper is based.

The Situation of the Parathyroid Bodies.—Their position in man is, in general, much lower than in dogs, the higher of the two glands of one side being, on the average about at the level of the junction of the upper and middle thirds of the lateral lobe of the thyroid gland. Occasionally a parathyroid is found as high as, or even above the superior pole of the thyroid gland. In one instance at the operating table I happened to find a parathyroid above the level of the superior pole of the thyroid gland. The lower of the two glandules, rarely as high as the middle of the thyroid lateral lobe, is usually not far from the lower pole, but may be several centimetres below it—even within the bony thorax. With great regularity these little epithelial bodies are situated on or very near the posterior border of the lateral lobe of the thyroid gland and more or less in line with an important landmark, the "channel" of anastomosis between the superior and inferior thyroid arteries.

The Blood Supply.—As determined by Mr. Evans each glandule has invariably its special artery which might be designated the superior and inferior parathyroid artery right and left. This little vessel surprises one by its size, being large in proportion to the organ supplied, and thus aids in the identification of the epithelial body. The parathyroid artery is particularly serviceable as a guide to the parathyroid gland when the latter is enveloped in fat. Ordinarily these glandules are quite free and, as cherries on the stem, hang from the artery which, as described by Mr. Evans, enters its "hilus."

The usual shape of the bodies is indicated in the drawings.

[8] In another communication Mr. Evans will give in greater detail the result of his study of the circulation of the parathyroid glandule.

They are ordinarily ovoid and flattish, presenting a sharpish edge which may as a rule be easily curled or folded. The surface markings which give the glandule an exceedingly fine, barely visible granular appearance are probably due to the blood vessels. Differentiation from adipose or thyroid tissue is rarely difficult unless the natural appearances have been obscured by trauma or staining.

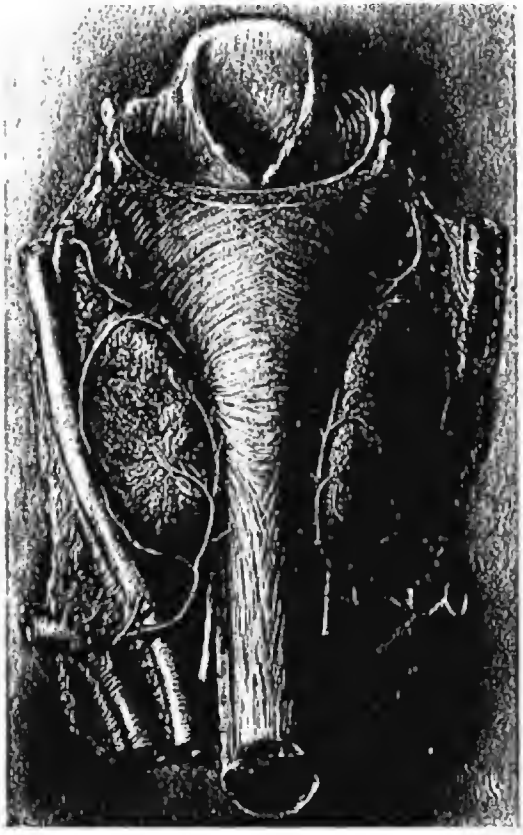
To Save the Parathyroid Glands in Performing Thyroid Lobectomy.—We have seen that from the superior and inferior thyroid the parathyroid arteries almost invariably arise, but we may assume that by the way of the œsophageal or other branches of anastomosis a number of parathyroid glands have been rescued; otherwise it would be difficult to explain the large percentage of recoveries which followed simultaneous ligation in man of all four of the thyroid arteries in the total excisions of a quarter of a century ago. It is important to note that these excisions were not undertaken for the hypertrophic forms of goitre.

Total extirpation performed in this manner in cases of Graves' disease would, perhaps, rarely fail to be followed by tetany. But it frequently happens that more than one lobe, or indeed that the greater portion of both lobes has, in two or more acts, to be removed in hypertrophy of the thyroid gland.

The "subcapsular" proceedure of Dr. Chas. H. Mayo, is, I believe, correct in principle, and, with the proper observance of details, for knowledge of which we are indebted to more complete acquaintance with their vascular supply, one or perhaps both parathyroid glandules of a side may be saved. But only with the exercise of the greatest caution; for, between the point at which the branch giving off the parathyroid artery enters the thyroid lobe and the origin of the latter vessel, there may be hardly room for one fine pointed artery forceps and not space for a broader-nosed clamp, as, for example, the admirable instrument of Ochsner; and still less for two clamps.

On two occasions, recently, in the operation for exopthalmic goitre, there was not room even for the fine point of our "mosquito clamp," and twice I deliberately cut off the blood

Fig. 7.



Parathyroid Glandules.

supply of the inferior parathyroid gland seeing no alternative save preserving a portion, too considerable, of the thyroid lobe. On several occasions, operating for exophthalmic goitre, I have transplanted into the thyroid gland a parathyroid glandule which had been deprived of its blood supply.

The drawings of Mr. Evans happen to be made from specimens which do not illustrate this point particularly well; but in figures 2 and 7 the inferior parathyroid is given off from a branch of the inferior thyroid artery only a few millimetres from the point at which the latter penetrates the thyroid gland. In fig. 3, also, the inferior glandule, a centimetre or more below the inferior pole of the thyroid gland, might easily be deprived of its blood supply if its artery were not recognized in the course of the operation. There is room in this instance for the application of 2 ordinary artery clamps distal to the point of origin of the parathyroid arteriole; but it should be observed that a nicely injected, carefully dissected specimen makes plain conditions which, in the course of an operation might be overlooked. The remaining glandules of the illustrations might with care escape destruction, for their arterioles are very short and arise in the main from the anastomotic channel or quite near to this vessel.

The term "subcapsular" expresses the operation of ultra-ligation very well, it seems to me, and I find it exceedingly convenient. It may be objected that there is normally no demonstrable capsule underneath or in the plane of the blood vessels of the thyroid gland, but the term proposed by Mayo is, nevertheless, not confusing and will not easily be relinquished. As a matter of fact there is not infrequently in cases of goitre, an intimate capsule enmeshing the vessels, which can not only be seen during the dissection but demonstrated thereafter.

The Operation of Ultra-ligation in Exophthalmic Goitre.—The operation of ultra-ligation or ligation beyond the origin of the parathyroid arterioles is quite simple if properly performed, but may prove very difficult, if not. The skin incision is usually made to correspond with one of the transverse lines of the neck, its length depending upon the size of the goitre

and upon the height of the superior pole of the thyroid. For a better cosmetic effect, in the case of women, we often determine the precise line for the incision with the patient in a sitting posture, consulting her as to the fall of the necklaces which she wears with evening dress. If the line is prescribed in the recumbent position the scar may fall too low. The platysma muscle, carefully reflected upwards in the skin flap, may be divided at a slightly higher level than the skin. In the dissection of this flap and indeed throughout the operation the injury to veins should be avoided as studiously as possible. A vertical, mid-line incision through the fascia is carried only deep enough to enable one to raise the sterno-hyoid and omo-hyoid muscles. It is an excellent suggestion of Chas. Mayo's to divide these muscles near their hyoid insertion, and between clamps which are not removed until it becomes necessary to do so, to permit the placing of the muscle suture.

It has not been my practice, however, to include in these clamps, the sterno-thyroid muscle. I believe that one is less likely to stain the deep wound if the sterno-thyroid muscle is carefully divided by itself after the hyoid muscles have been reflected, and in such a manner as not to cause the rupture of the fine and easily torn vessels which one encounters in raising this thinly spread out, capsule-like muscle from the thyroid gland. Moreover, one cannot reflect the omo-hyoid and sterno-hyoid muscles to so high a point if the sterno-thyroid muscle is included. The latter muscle being well divided and the previously severed muscles forcibly reflected by means of the strong muscle-clamps, one may gently raise the thyroid lobe from its bed on a spatula-like knife handle carefully insinuated between the delicate blood vessels just coming into view.

Contrary to the universal custom, I do not as a rule, complete at this moment the full delivery of the entire gland, for fear of soiling, but grasp very firmly between thumb and finger the superior pole and pull it forwards and towards the mid-line far enough to make the ultra-ligation of the superior thyroid vessels perfectly easy. Attempts to completely dislocate the entire gland or the inferior pole in this manner at this

stage of the operation may cause the rupture of some delicate blood vessels and consequent staining of the field containing the parathyroid glandules. But, if judiciously done in the manner described, the superior pole may be fearlessly grasped, because at this horizontal level there are no vessels behind the superior pole likely to be torn. When the superior thyroid vessels have been safely passed by the thumb or finger one may proceed with considerable roughness and without fear of hemorrhage to dislocate even the highest and deepest superior pole.

This grasp of the upper portion of the lobe putting on stretch the superior thyroid vessels must not be relinquished until released by the ultra-division of the finest branches distributed to the thyroid gland in the vicinity of the superior pole. The upper end being thus liberated the delivery of the entire lobe is continued, and without the tearing of the blood vessels. From this step on, throughout the operation, until the last vessel has been divided the thyroid lobe must be firmly drawn towards the opposite side, alternate relaxation and compression and undue pressure on the trachea being carefully avoided. From above downwards and from before backwards the vessels as they bind or as they present must be clamped and divided at their point of entrance into the gland, as far peripherally as possible.

Except in the case of the larger branches it is usually unnecessary to clamp the distal end of the cut vessel, hemorrhage from the gland side being prevented by the pressure exerted on the thyroid lobe by the unremitting traction towards the opposite side of the neck. By this method the recurrent laryngeal nerve, usually seen, is little endangered. In the course of the liberation of the lobe the nerve may be dragged well to the front of the trachea: of the right nerve this is particularly true. When in the immediate neighborhood of this nerve, at what might erroneously be termed the hilus of the thyroid lobe, one plunges the sharp pointed clamps into the thyroid gland, seizing the binding vessels after they have disappeared from view in its substance. When the habit is well

acquired little if any time is lost by practicing the clean, bloodless method of operating for goitre. The operation can be carefully performed in about the time required for its detailed description. For the removal of a thyroid lobe in a moderately difficult case of exophthalmic goitre, ten minutes is ample time if the experienced, skillful operator is well assisted.

I am not convinced that very light general anæsthesia with ether skillfully given by an expert anæsthetist for only fifteen or twenty minutes is less safe, even in the gravest cases, than local anæsthesia plus the prolonged operative period and its attendant nerve strain. In operations for exophthalmic goitre the general anæsthesia should be administered only by an expert.

A nurse trained in the præ- and post-operative care of cases of Graves' disease should be in charge, and the patient should have a private, quiet room. We have knowledge of no analogous disease, and of no toxæmia comparable to that which follows operation upon people afflicted with hyperthyroidism. It is therefore particularly difficult for the uninitiated to realize how critical is the condition of so many of these patients until, as a demonstration, a death has been experienced.

As so impressively pronounced by Dr. Mayo at his clinic, saturation of the patient with water must be accomplished in one way or another. The surgeon must not accept excuses that water could not be given by mouth because it hurt the patient to swallow, and not by the intestine because the guttatim injections were expelled, unless the patient is uncontrollable; in such event prompt resort to subcutaneous infusion must be had.

Chilling or Freezing the Neck Before and After Operations for Graves' Disease.—It had not occurred to me until the end of June, a few days before leaving town for the summer, that excessive cold applied to the neck in these cases, particularly after operation, might delay the processes of repair and absorption and thus bridge over the period of greatest danger, the two or three days succeeding operation. Its employment was very imperfectly tested in three instances, but in all with beneficial results, it seemed to me, although one of the patients,

desperately ill before operation, did not recover. In no instance, unfortunately did we succeed, with the inadequate appliances at our disposal, in doing much more than slightly cool the surface of the skin. In one case, 36 hours after operation, the pulse which had been steadily rising until it reached 180, dropped 30 beats per minute within one and one half hours of the application of the cold. In another, a good night's sleep, the first in weeks, seemed to be attributable to the application of cold to the neck. It is quite possible that harm rather than good might be done by ineffectually applied ice bags. They might serve as a poultice if, for example, swathed in protecting flannel, or if negligently attended to. The danger of reaction, too, must be constantly borne in mind—the reaction following either a brief or a prolonged use of the cold. Therefore no time should be lost in changing the packs; and ultimately the cold should gradually be withdrawn. I doubt the ability of the rubber ice bag to produce a degree of cold sufficient for the very ill cases; or the non-conducting rubber should, perhaps, be so thin that rents would be hardly avoidable. In some cases a degree of cold low enough almost to freeze the skin might be necessary. Possibly to be considered as a method of treatment for desperately ill cases is an unclosed wound constantly irrigated with water of the desired temperature.

I am convinced that the toxæmia is not simply due to the absorption of thyroid secretion. Otherwise might not the gravest cases of exophthalmic goitre be safely treated by total excision of the thyroid gland? It is my belief that the toxæmia incident to wound healing is badly borne by the subjects of hyperthyroidism. On several occasions, soon after thyroid lobectomy, I have seen prompt and great improvement follow the liberation of a drachm or even a few drops of reddish serum from the wound. Moreover the typical post-operative toxæmia may, it seems, follow operations of other kinds upon patients afflicted with Graves' disease. Absorption takes place continuously during the process of repair, even in wounds which are "dry" and healing throughout by first intention. Thus it

seems to me quite reasonable to hope that something, perhaps much, may be accomplished by the adequate employment of cold. The entire neck fore and back and sides, and from chin to chest might be made so cold in the serious cases as to arrest for a time, more or less completely, the process of absorption and possibly of healing.

Furthermore, if absorption from the wound is, even in a measure, responsible for the toxæmia so badly borne, the area of the wound surfaces must be a factor influencing the result; and, if so, there would be in this an indication for as small a wound as feasible in certain cases. A vertical skin incision to avoid reflection of a flap might be tested and less complete division of the muscles at their attachment to the hyoid bone might suffice for the liberation, in the manner described in this paper of the superior pole. The operation of ultra-ligation might thus be effected through a hole just large enough to permit the delivery of the lateral lobe of the thyroid gland.